



Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at <http://about.jstor.org/participate-jstor/individuals/early-journal-content>.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

The first value of a_1 is worthy of note; for if it were required to determine the position of four circles b, c, b_1, c_1 of given magnitude, that touch each other consecutively, so that a circle could be drawn touching all, the equation $a_1 = a$, shows that each of these circles fulfills this condition.

Again, a, b, c , being the radii of the first, we have the following relations connecting the radii of the circles of the various groups.

$$\left. \begin{array}{l} \frac{1}{a_1} = \frac{1}{m} - \frac{1}{a} \\ \frac{1}{b_1} = \frac{1}{m} - \frac{1}{b} \\ \frac{1}{c_1} = \frac{1}{m} - \frac{1}{c} \end{array} \right\} \text{2nd,} \quad \left. \begin{array}{l} \frac{1}{a_2} = \frac{1}{m_1} - \frac{1}{a_1} \\ \frac{1}{b_2} = \frac{1}{m_1} - \frac{1}{b_1} \\ \frac{1}{c_2} = \frac{1}{m_1} - \frac{1}{c_1} \end{array} \right\} \text{3rd,} \quad \left. \begin{array}{l} \frac{1}{a_x} = \frac{1}{m_{x-1}} - \frac{1}{a_{x-1}} \\ \frac{1}{b_x} = \frac{1}{m_{x-1}} - \frac{1}{b_{x-1}} \\ \frac{1}{c_x} = \frac{1}{m_{x-1}} - \frac{1}{c_{x-1}} \end{array} \right\} x+1.$$

Now substituting for $1 \div a_1, 1 \div b_1, 1 \div c_1$ in the third group, their values as given in the second, and carrying the resulting values of $1 \div a_2, 1 \div b_2, 1 \div c_2$ into the fourth, and so on, to the $(x+1)$ th group, we find that

$$\frac{1}{a_x} + \frac{1}{a} = \frac{1}{b_x} + \frac{1}{b} = \frac{1}{c_x} + \frac{1}{c} = \frac{1}{m_{x-1}} - \frac{1}{m_{x-2}} + \dots + \frac{1}{m},$$

when x is odd, and

$$\frac{1}{a_x} - \frac{1}{a} = \frac{1}{b_x} - \frac{1}{b} = \frac{1}{c_x} - \frac{1}{c} = \frac{1}{m_{x-1}} - \frac{1}{m_{x-2}} + \dots - \frac{1}{m}$$

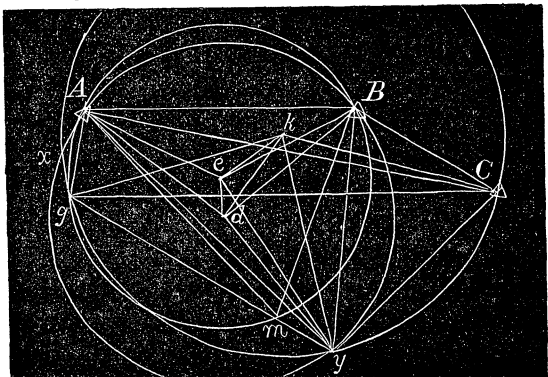
when x is an even number.

A PROBLEM IN SURVEYING.

BY T. J. LOWRY, M. S., SAN FRANCISCO, CALIFORNIA.

Problem.—Required the positions of the two places of observation y and m , with reference to three known points A, B and C , having observed at m the angles AmB and Bmy and at y the angles ByA and Cym .

Trig. Analysis.—In the isosceles $\triangle ABe$ we have the base AB and $\angle AeB (=2AmB)$, and hence all the \angle s to find Ae or Be . And in $\triangle Ade$ are known $\angle Aed (=180^\circ - AmB)$, side Ae , and $\angle Ade (=AyB)$ to get Ad and de . Now in isosceles $\triangle Age$ having sides Ae and ge , and $\angle Aeg [=$



$2(180^\circ - AmB - Bmy)]$ we get Ag . Then in $\triangle gAC$ are given gA , AC , and $\angle gAC (= gAe + eAB - BAC)$ to find gC and $\angle AgC$. And then in isosceles $\triangle gkC$ we have gC and $\angle gkC [= 2(180^\circ - gyC)]$ and hence all the angles, to determine $gk (= kC)$. Now in $\triangle kge$ are known kg , ge and $\angle kge (= kgC + Age - AgC)$ to get ke and $\angle gek$.

In $\triangle ked$ we know de , ek and $\angle dek (= 360^\circ - gek - ged)$ and hence all the angles and side dk . And in $\triangle dky$ we have all the sides and hence all the angles. In $\triangle yke$ are known ke , ky and $\angle eky (= dky + dke)$ to find ey . Then in $\triangle Aey$ having ey , Ae and $\angle Aey (= 360^\circ - yek - gek + Aeg)$ we find Ay . And in $\triangle ABy$ are known Ay , AB and observed $\angle AyB$ to get yB and $\angle yAB$. Now in $\triangle CAy$ we have Ay , AC and $\angle yAC (= yAB - BAC)$ to find $\angle AyC$. Then since $\angle Aym = Cym - AyC$, and the $\angle yAm = 180^\circ - Bmy - BmA - Aym$, we have in the $\triangle mAB$ known the $\angle mAB (= yAB + yAm)$, the side AB , and the $\angle AmB$ to find Am and Bm .

Geom. Const.:—Through A and B lay down circles of position containing respectively the angles AmB and AyB . Then from AB at A lay off $\angle BAg = Bmy$ and at B the $\angle ABg = 180^\circ - AmB - Bmy$, and g the point of intersection of the two lines thus drawn will be a secant point of the circle ABm and the right line through m and y . Now through g and C sweep a circle of position containing the observed angle gyC , and y , a secant point of this and the position circle ABy , is one of the required places of observation (an approximate knowledge of his position will in general tell the observer whether he was at y or x); then draw the right line yg and m the point where it cuts the circle ABm is the other place of observation.

A more general statement of the Rule given at page 146, vol. I, of the ANALYST, for plotting the centre of a circle of position is:—At each end of the line, joining the two observed signals, lay off the difference between the observed angle and 90° , on the same side of this line as the place of observation if the observed angle is less than 90° , but if greater than 90° , on the opposite side. And if the observed angle $= 90^\circ$ then the centre of the position circle is at the middle point of the line joining the signals.

SOLUTION OF PROBLEM 94. (SEE PAGE 199, VOL. II.)

BY PROF. W. W. BEMAN, ANN ARBOR, MICH.

FROM the figure we easily obtain,

$$\cos \alpha = \frac{y^2 + (c + x)^2 + (a + s)^2 - r^2}{2(a + s)\sqrt{y^2 + (c + x)^2}}, \dots \dots \dots (1)$$